

CLAIMS

We claim:

1. A DC power pooling system comprising:
 - 5 a plurality of DC electrical power consuming and providing entities, each of said plurality of DC electrical power consuming and providing entities having at least a first operative mode in which it may provide more electrical power than it consumes and a second operative mode in which it may consume more electrical power than it provides;
 - 10 DC electrical power interconnections, interconnecting said plurality of DC electrical power consuming and providing entities and permitting electrical power flow thereto and therefrom; and
 - at least one pooling controller operative to vary at least one of voltage, output impedance and current of electrical power provided by at least one of said
 - 15 plurality of DC electrical power consuming and providing entities.
2. A DC power pooling system according to claim 1, wherein each of said plurality of DC electrical power consuming and providing entities comprises at least one DC electrical power source and at least one electrical power load.
- 20 3. A DC power pooling system according to claim 2, wherein said DC electrical power source receives AC mains power and converts said AC mains power to DC electrical power.
- 25 4. A DC power pooling system according to claim 2, further comprising at least one power sharing circuit associated with said at least one DC electrical power source, said at least one power sharing circuit being responsive to an output of said at least one pooling controller to vary said at least one of voltage, output impedance and current of electrical power provided by said at least one DC electrical power source.
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5. A DC power pooling system according to claim 4, wherein said at least one DC electrical power source comprises a power supply controller, and wherein said at least one power sharing circuit is operable to modify the operation of said power supply controller.

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6. A DC power pooling system according to claim 1, wherein said pooling controller receives for each of said plurality of DC electrical power consuming and providing entities information relating to DC electrical power needs and DC electrical power providing capabilities.

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7. A DC power pooling system according to claim 2, wherein said pooling controller receives at least one of power needs of said at least one electrical power load and power providing capabilities of said at least one DC electrical power source.

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8. A DC power pooling system according to claim 1, further comprising a supply interface unit associated with at least one of said DC electrical power interconnections, said supply interface unit being responsive to an output of said at least one pooling controller to control said electrical power flow.

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9. A DC power pooling system according to claim 8, wherein said supply interface unit comprises at least one adjustable current limiter responsive to an output of said at least one pooling controller, said at least one adjustable current limiter being operative for limiting at least one of said electrical power flow to at least one of said plurality of DC electrical power consuming and providing entities and from at least one of said plurality of DC electrical power consuming and providing entities.

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10. A DC power pooling system according to claim 8, wherein said supply interface unit comprises at least one current sensor, said at least one current sensor being operative for sensing at least one of said electrical power flow to at least one of said plurality of DC electrical power consuming and providing entities and from at least one of said plurality of DC electrical power consuming and providing entities.

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11. A DC power pooling system according to claim 10, wherein said supply interface unit comprises a telemetry output operable to communicate with said at least one pooling controller, said telemetry output comprising information regarding at least one of direction and extent of electrical power flow.

12. A DC power pooling system according to claim 1, wherein at least one of said plurality of DC electrical power consuming and providing entities comprises a temperature sensor having a temperature indicating output, wherein said at least one of said plurality of DC electrical power consuming and providing entities communicates information regarding said temperature indicating output to said at least one pooling controller.

13. A DC power pooling system according to claim 4, wherein power sharing circuit comprises a temperature sensor having a temperature indicating output, said at least one power sharing circuit being operable to communicate information regarding said temperature indicating output to said at least one pooling controller.

14. A DC power pooling system according to claim 1, wherein at least one of said plurality of DC electrical power consuming and providing entities comprises at least one of a modem, a switch, a switch providing power over Ethernet and operating in accordance with IEEE 802.3af Standard, an Internet Protocol telephone, a computer, a server, a camera, an access controller, a smoke sensor, a wireless access point and a battery pack module.

15. A DC power pooling system according to claim 1, further comprising an overcurrent protection circuit associated with at least one of said DC electrical power interconnections.

16. A DC power pooling system according to claim 15, wherein said overcurrent protection circuit comprises at least one of a fuse and a circuit breaker operative to prevent excess power flow.

5 17. A DC power pooling system according to claim 1, further comprising a power supply module interconnected with at least one of said DC electrical power interconnections, said power supply module being operative to supply power to at least one of said plurality of DC electrical power consuming and providing entities when said at least one of said plurality of DC electrical power consuming and providing entities is
10 operative in said second mode.

18. A DC power pooling system according to claim 1, further comprising a power supply module interconnected with at least one of said DC electrical power interconnections, and wherein said power supply module is operative in response to an
15 output of said at least one pooling controller to supply power to at least one of said plurality of DC electrical power consuming and providing entities when said at least one of said plurality of DC electrical power consuming and providing entities is operative in said second mode.

20 19. A DC power pooling system according to claim 1, further comprising a battery pack module interconnected with at least one of said DC electrical power interconnections, and wherein said battery pack module supplies power to at least one of said plurality of DC electrical power consuming and providing entities when said at least one of said plurality of DC electrical power consuming and providing entities is operative
25 in said second mode.

20. A DC power pooling system according to claim 1, wherein at least one of said DC electrical power interconnections are arranged in one of a hierarchical star topology and a hierarchical ring topology.
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21. A method of DC power pooling comprising:

providing a plurality of DC electrical power consuming and providing entities, each of said plurality of DC electrical power consuming and providing entities having at least a first operative mode in which it may provide more electrical power than it consumes and a second operative mode in which it may consume more electrical power than it provides;

providing at least one pooling controller;
interconnecting said plurality of DC electrical power consuming and providing entities thereby permitting electrical power flow thereto and therefrom; and
varying at least one of voltage, output impedance and current of electrical power provided by at least one of said plurality of DC electrical power consuming and providing entities in response to an output of said at least one pooling controller thereby enabling DC power pooling.

22. A method of DC power pooling according to claim 21, wherein each of said plurality of DC electrical power consuming and providing entities comprises at least one DC electrical power source and at least one electrical power load.

23. A method of DC power pooling according to claim 22, further comprising:
receiving AC mains power by said each of said plurality of DC electrical power consuming and providing entities;
converting said AC mains power to DC power; and
providing said DC power to said at least one electrical power load located in said each of said plurality of DC electrical power consuming and providing entities.

24. A method of DC power pooling according to claim 22, further comprising:
providing at least one power sharing circuit associated with said at least one DC electrical power source, and wherein said varying is accomplished by said at least one power sharing circuit.

25. A method of DC power pooling according to claim 24, wherein said at least one DC electrical power source comprises a power supply controller, and wherein said varying is accomplished by modifying the operation of said power supply controller.

5 26. A method of DC power pooling according to claim 21, further comprising:
receiving for each of said plurality of DC electrical power
consuming and providing entities information relating to DC electrical power needs and
DC electrical power providing capabilities,
wherein said varying is accomplished at least partially in response
10 to said received information.

27. A method of DC power pooling according to claim 22, further comprising:
receiving by said pooling controller at least one of power needs of
said at least one electrical power load and power providing capabilities of said at least
15 one DC electrical power source.

28. A method of DC power pooling according to claim 21, further comprising:
providing a supply interface unit associated with at least one of
said plurality of DC electrical power consuming and providing entities; and
20 controlling said electrical power flow in response to an output of
said at least one pooling controller.

29. A method of DC power pooling according to claim 28, wherein said
controlling comprises:
25 limiting at least one of said electrical power flow to at least one of
said plurality of DC electrical power consuming and providing entities and from at least
one of said plurality of DC electrical power consuming and providing entities.

30. A method of DC power pooling according to claim 28, further comprising:

sensing at least one of said electrical power flow to at least one of said plurality of DC electrical power and consuming entities and from at least one of said plurality of DC electrical power and consuming entities.

5 31. A method of DC power pooling according to claim 30, further comprising:
 communicating information relating to at least one of direction and
amount of electrical power flow sensed by said sensing to said at least one pooling
controller.

10 32. A method of DC power pooling according to claim 21, further comprising:
 sensing a temperature of at least one said plurality of DC electrical
power consuming and providing entities; and
 communicating information relating to said sensed temperature to
said at least one pooling controller.

15 33. A method of DC power pooling according to claim 24, further comprising:
 sensing a temperature of said at least one DC electrical power
source;
 communicating information relating to said sensed temperature to
20 said at least one pooling controller.

 34. A method of DC power pooling according to claim 21, wherein at least
one of said plurality of DC electrical power consuming and providing entities comprises
at least one of a modem, a switch, a switch providing power over Ethernet and operating
25 in accordance with IEEE 802.3af Standard, an Internet Protocol telephone, a computer, a
server, a camera, an access controller, a smoke sensor, a wireless access point and a
battery pack module.

 35. A method of DC power pooling according to claim 21, further comprising:
30 protecting at least one of said plurality of DC electrical power
consuming and providing entities against excess electrical power flow.

36. A method of DC power pooling according to claim 35, wherein said protecting comprises:

5 providing at least one of a fuse and a circuit breaker operative to prevent excess electrical power flow.

37. A method of DC power pooling according to claim 21, further comprising:

10 providing a power supply module;
interconnecting said power supply module with said interconnected plurality of DC electrical power consuming and providing entities; and
supplying power from said power supply module to at least one of said plurality of DC electrical power consuming and providing entities when said at least one of said plurality of DC electrical power consuming and providing entities is operative in said second mode.

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38. A method of DC power pooling according to claim 21, further comprising:

20 providing a power supply module;
interconnecting said power supply module with said interconnected plurality of DC electrical power consuming and providing entities; and
supplying power from said power supply module in response to an output of said at least one pooling controller to at least one of said plurality of DC electrical power consuming and providing entities when said at least one of said plurality of DC electrical power consuming and providing entities is operative in said second mode.

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39. A method of DC power pooling according to claim 21, further comprising:

30 providing a battery pack module;
interconnecting said battery pack module with said interconnected plurality of DC electrical power consuming and providing entities; and
supplying power from said battery pack module to at least one of said plurality of DC electrical power consuming and providing entities when said at least

one of said plurality of DC electrical power consuming and providing entities is operative in said second mode.

40. A method of DC power pooling according to claim 21, wherein said
5 interconnecting is done in at least one of a hierarchical star topology and a hierarchical ring topology.